Contributions to mineralogy, No. 51, by F. A. Genth. A new species, which has been named aguilarite, is described. It appears to be a cupriferous stephanite with an admixture of metallic silver.—Columbite of the Black Hills, South Dakota, by W. P. Blake.—The raised reefs of Fernando de Noronha, by Henry N. Ridley.—The cause of active compressive stress in rocks and recent rock flexures, by T. Mellard Reade.—A new phosphate from the Black Hills of South Dakota, by W. P. Headden.—Note on certain peculiarities in the behaviour of a galvanometer when used with the thermopile, by Ernest Merritt.—Supplementary notice on the polycrase of North and South Carolina, by W. E. Hidden and J. B. Mackintosh.

The *American Meteorological Journal* for March contains:—An article by S. M. Ballou, on Prof. Russell's theory of cold waves, published in the Report of the Chief Signal Officer for 1889. This article is a reprint of a paper read at the meeting of the New England Meteorological Society on January 20 last. According to Prof. Russell's theory, the cause of the cold area from which the cold wave is drawn is held to be a preliminary strong upward diminution of temperature in the air, a subsequent overturning, bringing the cold air to the surface and producing uniform temperature upwards, and a further cooling above, producing high pressure. The author points out that each of these assumptions would probably be questioned, and he considers each of them in detail, quoting from the works of various authorities upon the subject.—Temperature in high and low areas. This is a translation of the substance of a reply by Dr. Hann, in the *Meteorologische Zeitschrift* of September 1890, to the criticisms of Prof. Hazen. These papers have already been noticed at length in NATURE.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, April 30.—"The Passive State of Iron and Steel, Part III." By Thos. Andrews, F.R.S., M.Inst.C.E.

Series V., Set 1. *Relative Passivity of Wrought-iron and various Steel Bars, and the Influence of Chemical Composition and Physical Structure on their Passive State in Cold Nitric Acid.*—The passive state of iron or steel may have hitherto been regarded by many as a sort of fixed property pertaining to iron and steel alike, when immersed in cold strong nitric acid. The following experiments were made to investigate if the passivity was of a universally static character, or whether it varied with the chemical composition and general physical structure of the metal, and, if so, to what extent.

The experiments of Series V., Set 1, were made on bars of the various steels selected from the author's standard samples. The bars were cold drawn through a wortle, and were therefore different in physical structure to the rolled plates used in the second series of the experiments. An idea of their general properties will be obtained on reference to Part II., Tables IV. and V. A polished bar, $8\frac{1}{4}$ inches long, 0·310 inch diameter, of the steel to be tested was placed in the wooden stand W, along with a polished wrought-iron bar of equal size, and the pair were then immersed in $1\frac{1}{4}$ fluid ounce of nitric acid, 1·42 sp. gr., contained in the U-tube, the bars being in circuit with the galvanometer. The immersion was continued for the periods stated, and with the electro-chemical results given on Table VI.

The wrought-iron bars used in each experiment were cut from one longer polished rod, so as to afford a fair comparison of the relative passivity of the various steels, compared with the wrought-iron and also with each other. The results are the average of numerous experiments in each case.

The experiments of Series V., Set 1, on the relative passivity of wrought-iron, soft cast-steel, hard cast-steel, soft Bessemer steel, and tungsten steel, showed that wrought-iron was electro-positive to the steels with a considerable E.M.F., the wrought-iron being thus shown to be less passive than the steels.

Series V., Set 2. *Relative Passivity of Wrought-iron and various Steel Plates in Cold Nitric Acid*, sp. gr. 1·42.—In the following series of observations, the metals experimented upon consisted of plates of rolled wrought-iron, rolled steels made by the Bessemer, Siemens-Martin, or crucible cast steel processes, such as soft cast-steel, hard cast-steel, soft Bessemer steel, hard Bessemer steel, soft Siemens steel, hard Siemens steel, and they are of the chemical composition given on Table VII. The terms "soft" and "hard" relate only to difference of percentage of combined carbon, and not to their having undergone annealing or hardening processes. Each plate was 3 inches square, by $\frac{1}{8}$ inch thick = total area of exposure 19·5 square inches including edges, brightly polished all over, and had a long thin strip left on the top side, for convenience of attaching to the galvanometer connections. The whole of the wrought-iron plates, used as elements with the various steel plates, were cut from one larger wrought-iron plate, and were thus practically of uniform composition, thus ensuring an accurate comparison of the relative passivity of the wrought-iron compared with the different types of steels, and at the same time indicating relatively the influence of varied composition and structure on the passivity of the different classes of steels under observation. In each experiment, a polished wrought-iron plate and a polished steel plate were firmly placed in two small holes drilled through a thick plate-glass cover; the cover holding the two plates was then carefully placed closely over a porcelain vessel containing 15 fluid ounces of nitric acid, sp. gr. 1·42, the plates being fully immersed in the acid, and the protruding shanks of the bars connected in circuit with the galvanometer. The electro-chemical effects observed were then taken in the usual manner, and the results are given in detail on Table VIII., and indicated that wrought-iron was less passive than the steels, and further demonstrated that steels of a higher percentage of combined carbon are more passive than those of a lower percentage of combined carbon.

General Remarks.—It has been necessary to give in modified detail the effects observed during the periods of experimentation recorded on the Tables, Parts I., II., and III., so as to convey an accurate intimation of the method and nature of the research; and a brief *résumé* of some of the principal results and conclusions arrived at by the author up to the present time may now be given.

(1) The experimental observations of Part I., Series I., indicate that the influence of magnetization on the passive state of steel rods in cold nitric acid, sp. gr. 1·42, is not very great, but it was detectable with the delicate galvanometer and by the sensitive electro-chemical method pursued by the author in the investigation.

The effect of magnetization is more marked in warm nitric acid and when the iron is in a powdered state, as shown in the independent and separate experiments of Messrs. Nichols and Franklin on passive powdered iron in warm nitric acid, previously alluded to in Part I., by whom it was shown that the temperature of transition from the passive to the active state was very materially lowered by powerful magnetism; their experiments also indicate that the passive state of powdered iron cannot be fully overcome, even under strong magnetic influence, until a temperature of about 51° C. is reached.

(2) The author's experiments of Part I., Series II., at higher temperatures, confirm those of Part I., Series I., and further tend to demonstrate the influence of magnetization in somewhat lessening the passivity of steel, showing that even previous to the critical temperature point of transition from the passive to the active state, magnetized steel bars were rather less passive in warm nitric acid than unmagnetized ones.

(3) The results in Part II., Series III., show that the passivity of both unmagnetized wrought-iron and unmagnetized steel in nitric acid, sp. gr. 1·42, is considerably and proportionately reduced as the temperature of the acid increases, until the temperature point of transition from the passive to the active state is reached at a temperature of about 195° F., and it was also found that the wrought-iron was less passive in the warm nitric acid than cast-steel. (See also remarks at foot of Diagram I. in Part II.)

(4) The results of the observations of Part II., Series IV., indicate that Scheurer-Kestner was, to some extent, in error in regarding the passivity of iron as not dependent on the greater or less degree of saturation of the acid. The author's experiments herein recorded have shown that the passivity of the metals employed, viz. wrought-iron, soft cast-steel, hard cast-steel, soft Bessemer steel, and tungsten steel, was very materially increased with the concentration of the nitric acid; and it was also observed that wrought-iron was much less passive in the nitric acid of less concentration than most of the steels, the soft Bessemer steel being found about equal in passivity to the wrought-iron under the conditions of experimentation. A re-

ference to Table III. shows that a considerable amount of E.M.F. was developed between the various metals in every instance, which is a circumstance of much interest in connection with the passive state of iron and steel.

(5) The results obtained in Part III., Series V. and VI., on the relative passivity of wrought-iron and the various steels—soft cast-steel, hard cast-steel, soft Bessemer steel, hard Bessemer steel, soft Siemens steel, and hard Siemens steel—are of an important character, showing, by the delicate electro-chemical method employed, the sensitive influence of difference in chemical composition and physical structure, &c., on the passive state of the metals. Generally throughout this series of experiments it will be observed that the wrought-iron was electro-positive to the steels with a considerable E.M.F., amounting, in some cases, to as high as one tenth to one-seventh of a volt, the wrought-iron being thus shown to be less passive than the steels.

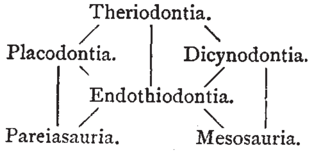
A reference to the experiments on the wrought-iron and various steel plates, on Table VIII., shows that the E.M.F. between the passive wrought-iron and the various soft steels, which contained less percentage of combined carbon, in circuit in cold nitric acid, sp. gr. 1·42, was very considerably less than the E.M.F. under similar conditions between the wrought-iron plates and the different hard steels having a higher percentage of combined carbon. The latter results, therefore, demonstrate the interesting circumstance that steels of a higher percentage of combined carbon are more passive than those of a lower percentage of combined carbon. It will be observed that the wrought-iron was also electro-positive to most of the steels, whether of a higher or lower percentage of combined carbon, which shows that wrought-iron may be regarded as generally less passive than steels.

May 14.—"Researches on the Structure, Organization, and Classification of the Fossil Reptilia. VII. Further Observations on *Pareiasaurus*." By H. G. Seeley, F.R.S., Professor of Geography in King's College, London.

All the affinities hitherto attributed to *Pareiasaurus* with Labyrinthodonts, Anomodonts, *Procolophon*, and Mammals are shown more strongly in the several parts of the skeleton, by the new evidence. The shoulder-girdle is more Labyrinthodont than was previously supposed, the skull is more Reptilian, and the pelvis and limbs are more Mammalian, though with some resemblance to Dinosaurs.

From furthur evidence of the structure of the skeleton in *Procolophon*, the author regards that type as a member of the Pareiasauria, rather than as forming a distinct sub-order. It also has four sacral vertebræ.

The divisions of the Anomodontia are grouped as—



Physical Society, May 9.—The Society varied its ordinary procedure by paying a visit to the ancient seat of learning situated on the banks of the Cam. Assembling at Liverpool Street Station, members and visitors to the number of about one hundred were conveyed in saloon carriages by the 11 o'clock express direct to their destination, the whole journey being accomplished in about seventy-five minutes. Amongst those present were Dr. E. Atkinson, Prof. Ayrton and Mrs. Ayrton, Mr. Walter Baily, Mr. Shelford Bidwell and Mrs. Bidwell, Mr. D. J. Blaikley, Mr. T. H. Blakesley and Mrs. Blakesley, Mr. J. T. Bottomley, Mr. C. V. Boys, Prof. Carey Foster, Mr. Conrad W. Cooke, Prof. Fitzgerald, Dr. E. Frankland and Mrs. Frankland, Dr. W. R. Hodgkinson, Prof. O. J. Lodge, Prof. Meldola, Prof. Perry and Mrs. Perry, Prof. Rücker, Dr. Sumpner, Prof. S. P. Thompson and Mrs. Thompson, Mr. A. P. Trotter and Mrs. Trotter, and Mr. G. M. Whipple. On arriving at the historic town the party became the guests of the Cambridge members, and proceeded to Emmanuel College, where they were received by Mr. W. N. Shaw. Various groups visited the cloisters, chapel, and gardens, and at one o'clock lunch was provided in the College Hall. At 2.30, a meeting of the Society was held in the Lecture Room of the Cavendish Laboratory. The papers read were all by authors resident in Cambridge, and the abstracts given below will sufficiently indicate the variety of the subjects brought before the Society. After the meeting the visitors inspected the Cavendish Laboratory. Amongst the many interesting instruments and apparatus to be seen, specially noticeable were Prof. J. J. Thomson's 50-feet vacuum tube, glowing from end to end with a luminous discharge; Mr. Shaw's pneumatic bridge, by which the pneumatic resistance or conductivity of various shaped orifices and channels can be compared; and the new air condensers to be used by Mr. Glazebrook as standards. The Cambridge Scientific Instrument Company had an interesting exhibit, including a dividing engine, Boys's radio-micrometer, electrically driven tuning-forks, and various recording instruments, amongst which was Galton's apparatus for registering the growth of plants. Other things which attracted attention were Glazebrook's spectrophotometer; Lord Rayleigh's coils and apparatus used in his determination of the ohm; a collection of models, medals, and instruments, formerly belonging to Prof. Maxwell; the resistance standards of the British Association, together with the historic rotating coils and electrodynamometer used in the determination of the B.A. unit. Tea was served in the Combination Room of Trinity College, and a majority of the visitors returned to town by the 8 o'clock express, greatly pleased with the day's outing. Others, however, prolonged their visit until Monday, and had opportunities of discussing important physical problems with the Cambridge members. The meeting was in every sense a great success, and will long be remembered as a red-letter day in the history of the Society.—At the science meeting, held in the Cavendish Laboratory, Prof. Ayrton, F.R.S., President, in the chair, the following communications were made:—Some experiments on the electric discharge in vacuum tubes, by Prof. J. J. Thomson, F.R.S. The phenomena of vacuum discharges were, he said, greatly simplified when their path was wholly gaseous, the complication of the dark space surrounding the negative electrode and the stratifications so commonly observed in ordinary vacuum tubes being absent. To produce discharges in tubes devoid of electrodes was, however, not easy to accomplish, for the only available means of producing an electromotive force in the discharge circuit was by electro-magnetic induction. Ordinary methods of producing variable induction were valueless, and recourse was had to the oscillatory discharge of a Leyden jar, which combines the two essentials of a current whose maximum value is enormous, and whose rapidity of alternation is immensely great. The discharge circuits, which may take the shape of bulbs or of tubes bent in the form of coils, were placed in close proximity to glass tubes filled with mercury, which formed the path of the oscillatory discharge. The parts thus corresponded to the windings of an induction coil, the vacuum tubes being the secondary and the tubes filled with mercury the primary. In such an apparatus the Leyden jar need not be large, and neither primary or secondary need have many turns, for this would increase the self-induction of the former and lengthen the discharge path in the latter. Increasing the self-induction of the primary reduces the E.M.F. induced in the secondary, whilst lengthening the secondary does not increase the E.M.F. per unit length. Two or three turns in each were found to be quite sufficient, and on discharging the Leyden jar between two highly polished knobs in the primary circuit a plain uniform band of light was seen to pass round the secondary. An exhausted bulb containing traces of oxygen was placed within a primary spiral of three turns, and on passing the jar discharge a circle of light was seen within the bulb in close proximity to the primary circuit, accompanied by a purplish glow which lasted for a second or more. On heating the bulb, the duration of the glow was greatly diminished, and it could be instantly extinguished by the presence of an electro-magnet. Another exhausted bulb surrounded by a primary spiral was contained in a bell jar, and when the pressure of air in the jar was about that of the atmosphere, the secondary discharge occurred in the bulb, as is ordinarily the case. On exhausting the jar, however, the luminous discharge grew fainter, and a point was reached at which no secondary discharge was visible. Further exhaustion of the jar caused the secondary discharge to appear outside the bulb. The fact of obtaining no luminous discharge either in the bulb or jar the author could only explain on two suppositions, viz. that under the conditions then existing the specific inductive capacity of the gas was very great, or that a discharge could pass without being luminous. The author had also observed that the conductivity of a vacuum tube without electrodes increased as the pressure diminished, until a certain point was reached, and afterwards diminished again, thus showing that the high resistance of a nearly perfect vacuum is in no way due to the presence of the electrodes. One peculiarity of the discharges was their local nature, the rings of light being much more sharply defined than was to be expected. They were also found to be most easily produced when the chain of molecules in the discharge were all of the same kind. For example, a discharge could be easily sent through a tube many feet long, but the introduction of a small pellet of mercury in the tube stopped the discharge, although the conductivity of the mercury was much greater than that of the vacuum. In some cases he had noticed that a very fine wire placed within a tube on the side remote from the primary circuit would present a luminous discharge in that tube.—Some experiments on the velocities of the ions, by Mr. W. C. D. Whetham. In studying electrolysis the question as to whether there is any transference of solvent when a porous wall is absent presented itself to the author. The ordinary methods of testing for transference, such as by increase of pressure, or by overflow, not being available, when there is no diaphragm, the author used different coloured solutions of the same salt, such as cobalt chloride in water and in alcohol, the former of which is red and the latter blue. By putting the solutions into a kind of U-shaped tube any change in the position of the line of junction of the two liquids could be measured. Two aqueous solutions in which the anion was the same were also tried, one combination being cupric chloride and common salt, and in this case the line of demarcation traversed about 7 inches in three hours. The results hitherto obtained by this method agreed fairly with those found by Kohlrausch.—On the resistance of some mercury standards, by Mr. R. T. Glazebrook, F.R.S. In 1885, M. Benoit, of Paris, supplied the author with three mercury standards, nominally representing the Paris Congress ohm, now commonly known as the legal ohm. Tests of these standards were described in a paper read before the Physical Society in 1885 by the present author. Recently he had occasion to compare two of the standards with the British Association coils. The mean of many concordant results gave the resistance of one of the mercury standards (No. 37) as 1·01106 B.A.U., whilst that of the other (No. 39) was 1·01032 B.A.U. Expressing them in legal ohms the present resistances are (No. 37) 0·99986 and (No. 39) 0·99913, whilst in 1885 the values obtained were (No. 37) 0·99990 and (No. 39) 0·99917. This shows that within the limits of experimental error the ratios of the mercury standards to the B.A. coils have remained practically unchanged during six years. The numbers given above are based on Lord Rayleigh's determination of the specific resistance of mercury, which differs appreciably from that found by Mascart and other observers. Taking the mean of the later concordant determinations, the values of the mercury standards expressed in legal ohms become (No. 37) 1·00033 and (No. 39) 0·99959. The values given by the maker were 1·00045 and 0·99954 respectively, showing a very close agreement. The author also found that refilling No. 37 from the same sample of mercury produced no appreciable change in its resistance, whilst No. 39 was somewhat affected by a similar operation. Experiments on the co-efficient of increase of resistance of mercury with temperature gave the value 0·000872 as the mean coefficient between 0° and 10° C., a number rather less than that obtained by Kohlrausch.—On an apparatus for measuring the compressibility of liquids, by Mr. S. Skinner. The apparatus consisted of a large spherical flask, with a long narrow neck containing the liquid to be experimented upon, the lower part of which was in communication through a stopcock and flexible tube with an adjustable reservoir. By raising or lowering the latter the flask could be easily filled or emptied or the quantity of liquid adjusted. The flask was inclosed in a bell jar, whose interior was in communication with a pump and barometer gauge. So sensitive was the arrangement that the compression of water produced by blowing into the jar caused the liquid to descend about 1 centimetre in the neck of the flask. This movement corresponded with a change of volume of about half a millionth. The coefficient of compressibility had been tested at different temperatures, and the results were not very different from those obtained by Tait and others. The influence of salts in solution in changing the compressibility had also been tested, and a great difference in this respect found between electrolytes and non-electrolytes.—Some measurements with the pneumatic bridge, by Mr. W. N. Shaw. The action of the apparatus is analogous in many respects to the Wheatstone's bridge, and its object is to compare the pneumatic resistances or conductivities of various orifices, channels, tubes, &c. The proportional arms are represented by two circular holes in thin plates of mica, the third arm by an aperture provided with a sliding shutter adjustable by a screw, and the fourth might consist of any aperture or tube whose conductivity was to be determined. The several apertures are pneumatically connected by large wooden boxes. The battery takes the form of a Bunsen burner with a long chimney, whilst the galvanometer is represented by a glass tube connecting opposite chambers, and containing a vane which sets itself at right angles to the tube when no air current is passing. The apparatus is remarkably sensitive to movements of the shutter, and on starting or stopping the draught after balance had been obtained, effects analogous to those produced by self-induction are observed. By its use it has been found that bevelling off one side of a hole in a thin plate increases the pneumatic conductivity of the aperture very considerably, particularly when the bevel is on the egress side. Another interesting result is that for square-ended tubes of given size the conductivity first increases as the length is made greater, and afterwards diminishes with further increase of length. Putting a flange on the outlet end reduces the anomalous effect, whilst a bevelled mouthpiece similarly placed causes it to disappear. In the discussion on Prof. Thomson's paper, Prof. Fitzgerald said the beautiful experiments were likely to lead to very important results. He did not quite understand how placing a fine wire in a vacuum tube could prevent the luminous discharge, for if the wire was on the side remote from the primary, and if there was any great increase in specific inductive capacity, he would have expected the air to screen the wire. Prof. Lodge asked for further information as to the action of the magnet in preventing the after-glow, and in some cases precipitating a luminous discharge. The experiment with the exhausted bulb within the bell jar was also difficult to understand, and he did not see why one of Prof. Thomson's two suppositions must necessarily be true. The President inquired whether Prof. Thomson had tried Mr. Crookes's experiment, in which the electric pressure necessary to produce a discharge was greatly lessened by putting a phosphorescent material in the tube. Prof. Thomson, in reply, said he had not tried the experiment, but the phosphorescence he had observed was of quite a different character from that produced in Mr. Crookes's tubes. To Prof. Fitzgerald he said the action of the wire was probably a question of time, and thought the whole field was in some way thrown on the wire and thus discharged. In reply to Prof. Lodge, he had not ascertained the true nature of the effect of a magnet on the glow, but he believed the glow to be due to a combination which might be prevented or facilitated by the action of the magnet causing the density to be different in different parts of the bulb. M. Guillaume, in discussing Mr. Skinner's paper, described the methods used by Sabine, Jamin, and others, in determining the compressibility of liquids, and pointed out their defects. The chief difficulty in such experiments was in finding the compressibility of the reservoir. Numbers expressing the compressibility of mercury obtained by different observers were given, the best values varying between 0·0000039 and 0·0000040.—On the motion of Prof. Ayrton, seconded by Prof. Rücker, a hearty vote of thanks was accorded to the authors for their valuable and interesting communications, and for the kind manner in which the Society had been received and entertained by the Cambridge members. Prof. Thomson and Mr. Glazebrook acknowledged the vote.

Geological Society, May 6.—Dr. A. Geikie, F.R.S., President, in the chair.—The following communications were read:—On a Rhætic section at Pylle Hill or Totter Down Bristol, by E. Wilson. In a deep railway-cutting at Pylle Hill, the Rhætic beds, having a thickness of not more than seventeen feet, are exposed between the Tea-Green Marls and the Lower Lias. There is no doubt as to the division between the Rhætic and Keuper beds in this section, but the line of demarcation between the Rhætic and the Lias has always been a matter of uncertainty in the West of England. In connection with this subject the term "White Lias," as applied to beds some of which are Rhætic and others Liassic, is held to be unsatisfactory. The author takes a limestone which is the equivalent of the Cotham Marble as the highest Rhætic bed in the section described. He divides the Rhætic beds of the cutting into an Upper Rhætic series and *Avicula contorta* Shales. The intimate connection betwixt the Tea-Green Marls and the Red Marls of the Upper Keuper is well displayed, whilst there is a sharp line of demarcation between the former and the *Avicula contorta* Shales. Most of the characteristic fossils of the British Rhætic are met with at Pylle Hill, together with a few forms which are new to England, and some of these possibly to science. A detailed section of the subdivisions of the Rhætic and adjacent beds, and a list of Rhætic fossils found in the section are given by the author. After the reading of the paper some remarks were made by Mr. Etheridge, Mr. H. B. Woodward, the Rev. H. Winwood, and Prof. T. Rupert Jones.—A microscopic study of the Inferior Oolite of the Cotteswold Hills, including the residues insoluble in hydrochloric acid, by Edward Wethered. The author gives the following main divisions of the Inferior Oolite of the Cotteswold Hills in descending order :—

Ragstones.
Upper Freestones.
Oolitic Marl.
Lower Freestones.
Pea Grit.
Transition Beds resting on Upper Lias.

The strata are described, and the results of microscopic examination of the different beds given. These latter confirm the author's views as to the important part which *Girvanella* have taken in the formation of oolitic granules ; whilst an examination of the borings referred to by Prof. Judd in the discussion of Mr. Strahan's paper "On a Phosphatic Chalk," convinces the author that these have no connection with the genus *Girvanella*. In the second part of the paper the insoluble residues left after treating the various deposits with acid are considered. They contain chiefly detrital quartz, felspars, zircons, tourmaline, chips of garnet, and occasionally rutile. In the argillaceous beds silicate of aluminia was found to occur plentifully. The detrital material is considered to be due to denudation of crystalline felspathic rocks, and not of stratified ones. This view seems to be supported by the quantity of felspar and its good state of preservation. The paper concludes with a consideration of the quantity of residue and the size of the quartz-grains in the different deposits, which are summarized in the following table :—

	Percentage of residue.	Size of quartz-grains, in millim.
Ragstones	2·8 ...	·17
Upper Freestones ...	1·1 ...	·12
Oolitic Marl	3·2 ...	·09
Lower Freestones ...	1·8 ...	·13
Pea Grit Series	5·0 ...	·14
Transition Beds	38·3 ...	·13

This shows a great falling off in the percentage of residue above the Transition Beds. That of the Freestones is remarkably low, and it would appear that these rocks were formed under conditions which allowed of very little sediment being deposited. The paper gave rise to a discussion, in which Prof. Hull, Mr. Etheridge, Mr. H. B. Woodward, the Rev. H. Winwood, and the author took part.

Royal Meteorological Society, May 20.—Mr. Baldwin Latham, President, in the chair.—The following papers were read :—On the vertical circulation of the atmosphere in relation to the formation of storms, by Mr. W. H. Dines. After giving an outline of the circulation of the atmosphere, the author refers to the two theories which have been suggested to account for the formation of storms, viz. (1) the convection theory, which is that the central air rises in consequence of its greater relative warmth, this warmth being produced by the latent heat set free by condensation ; and (2) the theory that the storms are circular eddies produced by the general motion of the atmosphere as a whole, just as small water eddies are formed in a flowing stream of water. The author is of opinion that the convection theory is the more probable of the two, but more information about the temperature of the upper air is greatly needed.—On Brocken spectres in a London fog, by Mr. A. W. Clayden. During the dense fogs in February last, the author made a number of experiments with the view of raising his own spectre. This he ultimately succeeded in accomplishing by placing a steady limelight a few feet behind his head, when his shadow was projected on the fog. He then made some careful measurements of the size and distance of the spectre, and also succeeded in taking some photographs of the phenomenon.—An account of the "Leste," or hot wind of Madeira, by Dr. H. Coupland Taylor. The "Leste" is a very dry and parching wind, sometimes very hot, blowing over the island from the E.N.E. or E.S.E., and corresponds to the sirocco of Algeria, or the hot north winds from the deserts of the interior experienced in Southern Australia. During its prevalence a thin haze extends over the land, and gradually thickens out at sea until the horizon is completely hidden. It is most frequent during the months of July, August, and September, and usually lasts for about three days.—Mr. Shelford Bidwell, F.R.S., exhibited an experiment showing the effect of an electrical discharge upon the condensation of steam. The shadow of a small jet of steam cast upon a white wall is, under ordinary conditions, of feeble intensity and of a neutral tint. But if the steam is electrified, the density of the shadow is at once greatly increased, and it assumes a peculiar orange-brown hue. The electrical discharge appears to promote coalescence of the exceedingly minute particles of water contained in the jet, thus forming drops large enough to obstruct the more refrangible rays of light. It is suggested that this experiment may help to explain the intense darkness, often tempered by a lurid yellow glow, which is characteristic of thunderclouds.

Linnean Society, April 16.—Prof. Stewart, President, in the chair.—A paper by the Rev. F. R. Wilson, was read, on lichens from Victoria, in which several new species were described, specimens of which were exhibited.—A paper by Surgeon-Major A. Barclay followed, on the life-history of two species of *Puccinia*, viz. *P. coronata*, Corda, and a new species which the author proposed to name *P. Jasmini-chrysopogonis*. A feature of peculiar interest noted in the latter species was the extraordinary abundance and wide distribution of the teleutosporic stage as compared with the comparative scarcity of the æcidial stage, and this disproportion in the distribution of the two stages had been remarked by the author long before he had ascertained that they were related.—A discussion followed, in which several of the botanists present took part.

May 7.—Prof. Stewart, President, in the chair.—Prof. R. J. Anderson exhibited a panoramic arrangement for displaying drawings at biological lectures.—Mr. John Young exhibited a nest of the Bearded Titmouse (*Calamophilus biarmicus*), which had been built in his aviary. Several eggs were laid, but none of them were hatched.—The Rev. E. S. Marshall exhibited several specimens of a Cochlearia from Ben More, believed to be undescribed.—Mr. Robert Deane forwarded for exhibition a plant of the Rayless Daisy, found growing abundantly in the neighbourhood of Cardiff; and an undetermined Sponge, dredged in about 40 fathoms, off the coast of South Wales.—Mr. D. Morris drew attention to a Jamaica drift fruit recently found on the coast of Devonshire. Although figured so long ago as 1640 by Clusius, and subsequently noticed by other observers, the plant yielding it had only lately been identified by Mr. J. H. Hart, of Trinidad, as *Sacoglottis amazonica*. Mr. Morris likewise exhibited specimens of the fruit of *Catostemma fragrans*, received for the first time, from St. Vincent, showing its true position to be amongst the *Malvaceæ*, tribe *Bombaceæ*.—Mr. Thomas Christy exhibited some Kola nuts, and made remarks on the properties attributed to their medicinal use.—A paper was then read by Mr. Malcolm Lawrie, on the anatomy of the genera *Pterygotus* and *Slimonia*, and their relationship to recent *Arachnida*. An interesting discussion followed, in which the President, Prof. Howes, Dr. H. Woodward, and others took part.

Entomological Society, May 6.—Mr. Frederick DuCane Godman, F.R.S., President, in the chair.—Dr. D. Sharp exhibited a number of eggs of *Dytiscus marginalis* laid on the sheath of a species of reed, and commented on the manner of their oviposition, which he said had been fully described by Dr. Régimbart.—The Rev. A. E. Eaton exhibited a collection of *Psychodidæ* from Somersetshire, including six species of *Psychoda*, eleven species of *Periconia*, and one species of *Ulomyia*. Mr. McLachlan commented on the interesting nature of the exhibition.—Mr. P. Crowley exhibited a specimen of *Prothoë caledonia*, a very handsome butterfly from Perak ; and a specimen of another equally handsome species of the same genus from Tonghou, Burmah, which was said to be undescribed.—Mr. H. Goss, the Secretary, read a letter from Mr. Merrifield, pointing out that the statement made by Mr. Fenn, at the meeting of the Society on April 1 last, of his views on the effects of temperature in causing variation in Lepidoptera, was incorrect ; he (Mr. Merrifield) had never suggested what might happen to *Tæniocampa instabilis*, and had expressly stated that he had found a reduction of the temperature below 57° to produce no effect, whereas in Mr. Fenn's experiments the temperature must have been below 40°.—The Secretary also read a letter which Lord Walsingham had received from Sir Arthur Blackwood, the Secretary of the Post Office, in answer to the memorial which, on behalf of the Society, had been submitted to the Postmaster-General, asking that small parcels containing scientific specimens might be sent to places abroad at the reduced rates of postage applicable to packets of *bonâ fide* trade patterns and samples. The letter intimated that, so far as the English Post Office was concerned, scientific specimens sent by sample post to places abroad would not be stopped in future.

Mathematical Society, May 14.—Prof. Greenhill, F.R.S., President, in the chair.—The following communications were made:—Relations between the divisors of the first n numbers, by Dr. Glaisher, F.R.S.—Wave motion in a heterogeneous heavy liquid, by Mr. Love.—Disturbance produced by an element of a plane wave of sound or light, by Mr. Basset, F.R.S.—On functions determined from their discontinuities and a certain form of boundary condition, and on a certain Riemann's surface, by Prof. W. Burnside.—Messrs. MacMahon, Larmor, Bryan, and the President took part in the discussions on the papers.

CAMBRIDGE.

Philosophical Society, May 4.—Prof. G. H. Darwin, President, in the chair.—The following communications were made:—The most general type of electrical waves in dielectric media that is consistent with ascertained laws, by Mr. J. Larmor.—A mechanical representation of a vibrating electrical system and its radiation, by Mr. J. Larmor.—The theory of discontinuous fluid motion in two dimensions, by Mr. A. E. H. Love. The paper contains an account of a modification of Mr. Michell's method. It is shown that, in all problems where the fixed boundaries consist of parts of *straight* lines, a figure can be constructed whose conformable representation upon a half plane gives rise to the equation of transformation which contains in itself the solution of the problem. The relation by which the representation is effected can in each problem be determined by known methods. The whole subject is thus reduced to integral calculus. Several new cases of the resistance offered by obstacles to the motion of fluids are solved. These include the determination of the mean pressure on a disk with an elevated rim, and of the mean pressure on a pier or other obstruction in a canal of finite breadth.—On thin rotating isotropic disks, by Mr. C. Chree. The subject treated is that of the rotation about their axes of thin disks whose section parallel to the plane faces consists of a circle or the area between two concentric circles. The paper aims at providing a solution which is not open to the objections recently urged by Prof. Pearson in NATURE against previous solutions.

PARIS

Academy of Sciences, May 19.—M. Duchartre in the chair.—Determination of the constant of aberration; numerical values deduced from two groups of four stars, by MM. Lœwy and Puiseux.—On the transit of Mercury, by M. J. Janssen. It is remarked that a conclusive confirmation of the solar origin of the corona would be obtained if Mercury were photographed when at a short distance from the edge of the sun, and appeared in the negative projected upon a luminous background.—On the physical explanation of fluidity, by M. Boussinesq.—The heat of combustion and formation of some chlorine compounds, by MM. Berthelot and Matignon. The experiments indicate that for each equivalent of hydrogen replaced by chlorine in a series of compounds from 30 to 32 calories is disengaged. Cl_n substituted for H_n thus disengages about $30n$ calories.—On a double halo with parhelia observed on May 15, 1891, by M. A. Cornu.—On a memoir, by Herr W. von Bezold, relative to the theory of cyclones, by M. Faye.—Remarks on the employment of carbon bisulphide in the treatment of phylloxerous vines, by M. A. F. Marion and G. Gastine.—On the intermediate integrals of equations from derived partials of the second order, by M. E. Goursat.—On an elementary method of establishing differential equations of which θ functions form the integral, by M. F. Caspary.—On a class of complex numbers, by M. André Markoff.—Quantitative studies of the chemical action of light; Part iii. influence of dilution, by M. Georges Lemoine. Experiments with mixtures of oxalic acid and ferric chloride taken in equivalent proportions but with different quantities of water indicate that the chemical action of light upon them increases with the excess of water. The action of heat upon the mixtures appears to follow the same laws as that of light.—Calculation of the temperatures of fusion and ebullition of normal paraffins, by M. G. Hinrichs. A comparison is given of the observed and calculated melting and boiling points of the normal paraffins. The method of calculation is contained in *Comptes rendus*, May 4, 1891.—On the action exercised by alkaline bases on the solubility of alkaline salts, by M. Engel.—On the detection of silica in the presence of iron, by M. Leclere.—On the constitution and heat of formation of bibasic erythrates, by M. de Forcrand.—Thermal data relative to propionic acid and the propionates of potash and soda, by M. G. Massol. Facts are stated which prove that propionic acid, in combining with potash or soda, disengages as much heat as its superior and inferior homologues, acetic and butyric acids.—On the heat of dissolution and the solubility of some organic acids in methyl-, ethyl- and propyl-alcohols, by M. Timofeiew. The results indicate that there is a relation between the molecular solubility and heat of dissolution, the variation of molecular solubility carrying with it a variation, in the opposite sense, of the heat of dissolution.—Action of chlorides of bibasic acids on cyanacetic ethers, by M. P. T. Muller.—On the formation of nitrates in the earth, by M. A. Muntz.—Considerations of abysmal waters, by M. J. Thoulet.—On the genus Royena of the family Ebenaceæ, by M. Paul Parmentier.—On an inferior Basidiomycete parasite of grapes, by MM. Pierre Viala and G. Boyer.—On a particular appearance of the Cretaceous formation in the Bou-Thaleb group, Algeria, by M. E. Ficheur.—A bed of nephritis found in China, in the Nan Chan mountain-chain, by M. Martin.—Correction to a note on a recently described fossil, by M. Stanislas Meunier.—Discovery of a human skeleton contemporary with the Quaternary volcanic eruptions of Gravenoire (Puy-de-Dôme), by MM. Paul Girod and Paul Gautier.—Chemical and physiological researches on microbic secretions; transformation and elimination of organic matter by the pyocyanic bacillus, by MM. A. Arnaud and A. Charrin.

CONTENTS.

PAGE

Medical Research at Edinburgh. By J. George Adami 73
The Chemical and Bacteriological Examination of Potable Waters. By **P. F. F.** 74
Our Book Shelf:—
- Johnstone: "Botany: a Concise Manual for Students of Medicine and Science."—**C. H. W.** 75
- Sim: "Hand-book of the Ferns of Kaffraria."—**J. G. Baker, F.R.S.** 75
- Deakin: "Rider Papers on Euclid" 76
- Lehmann: "Die Krystallanalyse" 76

Letters to the Editor:—
- The University of London.—**Prof. E. Ray Lankester, F.R.S.; Prof. William Ramsay, F.R.S.; Dr. Irving** 76
- Quaternions and the "Ausdehnungslehre."—**Prof. J. Willard Gibbs** 79
- The Flying to Pieces of a Whirling Ring.—**G. Chree** . 82
- A Comet observed from Sunrise to Noon.—**Captain Wm. Ellacott** 82
- Graphic Daily Record of the Magnetic Declination or Variation of the Compass at Washington.—**Richardson Clooer** 82
- The Alpine Flora.—**J. Lovel** 83
- Magnetic Anomalies in Russia.—**General A. de Tillo** 83

The Rejuvenescence of Crystals. By **Prof. John W. Judd, F.R.S.** 83
British Institute of Preventive Medicine 86
Notes 86
Our Astronomical Column:—
- The Draper Catalogue of Stellar Spectra 89
- Solar Observations from January to March 1891 . . . 90
- The Constant of Aberration 90

Animal Life on a Coral Reef. By **Dr. S. J. Hickson** 90
Washington Magnetic Observations, 1886 91
University and Educational Intelligence 91
Scientific Serials 91
Societies and Academies 92